LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, April 25-29, 2011

Saving lives one brain at a time

LLNL mechanical engineer Mike King (left) and physicist Willy Moss watch a compression test of a helmet pad.

The U.S. military is considering using Army helmets with a thicker shell so the troops can come home safe and sound.

The Army and Marines are working on upgrading their protection in the Enhanced Combat Helmet (ECH). The outer shell is made from high-molecular-weight polyethylene plastic, but a new thicker protective shell would make the helmet lighter than the current Kevlar model.

A study by the Laboratory's Willy Moss and Mike King found the military helmets could be better, especially the foam padding inside the helmet. "We decided to change the thickness of the foams and look at the results," Moss said.

Currently, Kevlar helmets come with 3/4-inch foam pads inside. In recent months, the U.S. Army has provided some soldiers with 1-inch pads to make the helmet fit better.

By adding a quarter-inch of padding or even an eighth of an inch, "there is a very big effect" -- a 24 percent reduction in force to the skull, to be exact, Moss said.

To read more, go to the Web.

Where the wind blows

Normally invisible, wind wakes take shape in the clouds behind the Horns Rev offshore wind farm west of Denmark. *Photo courtesy of Vattenfall.*

On the Front Range within the Rocky Mountains, prevailing winds sweep eastward over the mountains smack into the National Wind Technology Center.

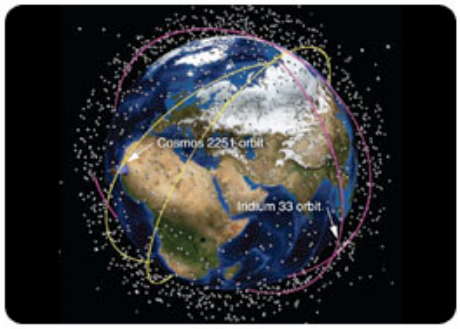
Several wind turbines, some taller than a 40-story building, spin and hum at the site, just outside of Boulder, Colo., waiting for an experiment to start in the next month.

The turbines not only produce power, they produce wakes -- similar to what forms in bodies of water -- that are invisible ripples, waves and other disturbances in the atmosphere that can damage turbines and decrease efficiency. Laboratory researchers and collaborators will launch a study of those wakes this month, with an eye toward improving the efficiency of wind farms.

The scientists also will collect valuable data that will help validate the wind flow models developed at Livermore and other laboratories and universities.

"This study is part of a larger suite of observational and model development efforts under way at LLNL to help attain aggressive state and national targets for renewable energy deployment," said Jeff Mirocha of LLNL. To read more, go to the Web.

Preventing close encounters of the orbiting kind



A Livermore visualization shows the orbits of the two satellites prior to the collision among

the hundreds of other orbiting satellites.

Each day, hundreds of active satellites as well as tens of thousands of pieces of "space junk" -- defunct satellites, bits of booster rockets and lost astronaut tools -- orbit Earth.

This space junk became front page news two years ago, when a defunct Russian satellite and a privately owned American communications satellite collided near the North Pole. The incident produced clouds of debris that quickly joined the orbital junk parade, increasing the possibility of future accidents.

Add to that the 80 countries that have joined the space community, and it would appear that space -- at least what's located immediately outside of Earth -- is getting a little short on space.

Help is on the way. Lawrence Livermore, in collaboration with Los Alamos and Sandia national laboratories and the Air Force Research Laboratory, is working to improve the nation's capabilities for detecting and monitoring threats to U.S. space operations.

To see a video, go to the Web.

Mining for fuel in the deep Earth

A snapshot taken from a first-principles molecular dynamics simulation of liquid methane in contact with a hydrogen-terminated diamond surface at high temperature and pressure.

The main building block of crude oil and natural gas, otherwise known as hydrocarbons, may be formed from methane in deep Earth at extreme pressures and temperatures.

The new research conducted by Laboratory scientists and collaborators is important for understanding hydrocarbon reservoirs and fluxes within Earth's crust. Knowledge about the thermodynamic and kinetic properties of hydrocarbons at high pressures and temperatures will assist in discovering more naturally occurring petroleum resources.

Hydrocarbons contribute to the global carbon cycle (one of the most important cycles of the Earth that allows for carbon to be recycled and reused throughout the biosphere and all of its

organisms).

The team includes colleagues at UC Davis, the Laboratory and Shell Projects & Technology.

To read more, go to the Web.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.
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